EFFECT OF DIFFERENT LEVELS OF *HELICOTYLENCHUS* NEMATODE INFESTATION ON THE GROWTH AND YIELD OF SWEET POTATO

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ABSTRACT

Low population density of Helicotylenchus **stimulated plant growth. Weights of tops, roots and tubers at a population of approximately 1,000 nematodes per plant were higher than those of the control. Plant growth was not retarded at low levels of nematode population. However, as the population was increased to 10,000 per plant, weights of tubers, roots and tops of sweet potato decreased, but only the difference in root weight was statistically significant.** Helicotylenchus **spp. tended to be parasitic, instead of pathogenic, to sweet potato.**

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KEY WORDS: *Helicotylenchus* spp. Nematode. Population density. Parasitic. Pathogenic. Sweet potato. Growth and yield.

INTRODUCTION

Sweet potato is prone to great damage by pathogens such as fungi, bacteria, viruses and nematodes. In the Philippines, millions of pesos are lost yearly because of nematode attack on agricultural crops (Davide, 1972). *Rotylenchulus reniformis, Meloidogyne* spp. and *Helicotylenchus* spp. have been reported as the most prevalent and widely distributed plant parasitic nematodes associated with sweet potato in the country (Castillo and Maranan, 1974; Gapasin, 1978). *Helicotylenchus* was also one of the genera found to be associated with sweet potato in the West Indies (Brathwaite, 1972).

Inoculation studies revealed that *Helicotylenchus* sp. is pathogenic to coconut and African oil palm (Pizarro, 1968; Valdez and Ferino, 1962). On the other hand, Walawala and Madamba (1972) cited that *H. erythrinae* did not reproduce in corn nor cause any appreciable damage to the crop. *Helicotylenchus* did not also cause any growth reduction in

lettuce (De la Rosa and Davide, 1969). Gapasin (1978) found that *Helicotylenchus* spp., at an initial population of approximately 1,000 individuals, tremendously increased in number in the soil and in roots of BNAS #51 variety of sweet potato 4 months after inoculation.

Although there had been studies made on the association of plant parasitic nematodes with sweet potato, inoculation studies using *Helicotylenchus* spp. are lacking. This study presents the effects of *Helicotylenchus* spp. on sweet potato variety BNAS #51.

MATERIALS AND METHODS

Planting of Sweet Potato. — Twenty healthy sweet potato cuttings measuring 30 cm long were collected from the field and then used as planting materials. A single stem cutting was planted in 25.4 cm diameter clay pots filled with sterilized soil. Each pot was provided with a piece of nylon cloth to prevent weevil infestation, at the center of which a single slit was made to allow the base of the cutting to pass through. Before planting, the base of the cutting was inserted through the slit, planted and then the slit was sewn closed. A thick cellophane was used to cover the holes of the pots to prevent the roots of the test plants from coming out, thus avoiding contamination.

A complete fertilizer (14-14-14) was applied at the rate of 1 g per pot after planting to induce early development of roots. The experimental area was kept free from weeds and the plants were watered daily throughtout the experiment. The plants were protected from foliar pests by spraying them with a contact pesticide (Parapest) at the rate of 0.05 ml/50 ml/H_20. During spraying, the pots were covered with plastic cellophane to prevent soil contact of pesticidal residues, which may have toxic effect on the nematodes. Four bamboo sticks were used as trellises for the vines to prevent the plants from crawling on the ground.

Isolation, Culture and Inoculation of Helicotylenchus spp.— Soil containing heavy population of nematodes was collected from the field planted with para grass *(Panicum purpurescens* Lam.). Nematodes were extracted from the soil using the Baermann funnel method and were then collected by gently releasing the suspension into 10 cc glass vials. The nematodes were allowed to settle in glass vials to facilitate removal of some of the water. The suspension was placed in a watch glass and *Helicotylenchus* spp. were individually picked using bamboo splinters under a stereoscopic microscope. The suspension containing the live nematodes was introduced and maintained in para grass grown in pots containing sterilized soil. *Helicotylenchus* spp. needed for the tests were taken from this stock culture of nematodes in para grass. Suspensions containing approximately 1,000, 3,000, 5,000 and 10,000 nematodes were prepared and kept in separate

containers until they were ready for use.

Two weeks after planting the sweet potato, the desired number of inoculum was placed in each pot. The nematode suspension was inoculated by pouring the suspension in holes made near the base of the plant, after which the holes were covered with soil. Uninoculated plants served as the control.

Treatments and Experimental Design.— A randomized complete block design was used in this experiment. Twenty pots were randomly arranged in the experimental area. Five different inoculum levels of *Helicotylenchus* spp. represented the 5 treatments and each treatment was replicated 4 times. Only one sweet potato plant was used per replication. The distance between blocks and between rows was 1 m.

RESULTS AND DISCUSSION

Reaction of Sweet Potato to Inoculation with Nematodes.

Pathogenicity tests of *Helicotylenchus* spp. revealed that different inoculum levels affected the weight of roots, tubers and tops. Plants with the lowest inoculum density (1,000 individuals) had greater mean weight of roots, tubers and tops compared to the other treatments (Table 1). The difference in root weight was statistically significant. It was observed that as the inoculum density was progressively increased to 10,000 individuals per pot, weight of tops, tubers and roots decreased correspondingly, although no damage on tubers was observed.

At the highest inoculum level, fewer roots were produced resulting in a decrease in total weight of roots

Table 1. Average weight (g) of roots, tubers and tops of BNAS-51 sweet potato four months after inoculation with *Helicotylenchus* spp.[1]

Inoculum Level	Fresh Weight (g)[2]			Nematode Population[3] (%)
	Roots	Tubers	Tops	
0	44.6 b	415.3	162.1	0
1,000	113.9a	496.4	267.3	116.55a
3,000	66.4b	416.3	254.3	56.38b
5,000	47.8b	403.4	202.2	62.45b
10,000	37.8b	400.8	137.7	34.82b

[1] Mean of 4 replications.

[2] Means followed by a common letter are not significantly different at 5% level (DMRT).

[3] Percentage population of *Helicotylenchus* spp. in soil and roots based from the initial inoculum; means followed by a common letter are not significantly different at 1% level (DMRT).

when compared to those of the uninoculated plants (Fig. 1). Increased root weight at the lowest inoculum level may be attributed to root proliferation which was probably brought about by the increased growth hormone production stimulated by nematode feeding. Studies on hormone production induced by nematodes showed that auxin levels were high in galls from Meloidogyne-infected plants (Viglercho and Yu, 1968). Varghese and Kumari (1970) further suggested that changes in auxin-kinin ratio in roots of eggplants infected with *Meloidogyne incognita acrita* may be responsible for the formation of adventitious roots in infected plants.

The increase in weight of tops and tubers was not significantly different from those of the other treatments. The insignificant values obtained despite large mean differences may be explained by the very high C.V. obtained due to large variability in the data measured. One source of variation may be the uneven growth of sweet potato when potted. Some plants produced numerous roots or tubers while others had few roots but no tubers. Even if grown in the field, sweet potato tends to be variable. This variability in the data obtained could have been reduced if more plants were used per replication. Because of the nature of the study, however, this was not possible.

The highest mean weight of tops inoculated with the lowest population level could be due to the stimulation of plant growth as a result of increased production of roots. Burstrom (1965) cited that with more roots, there would be

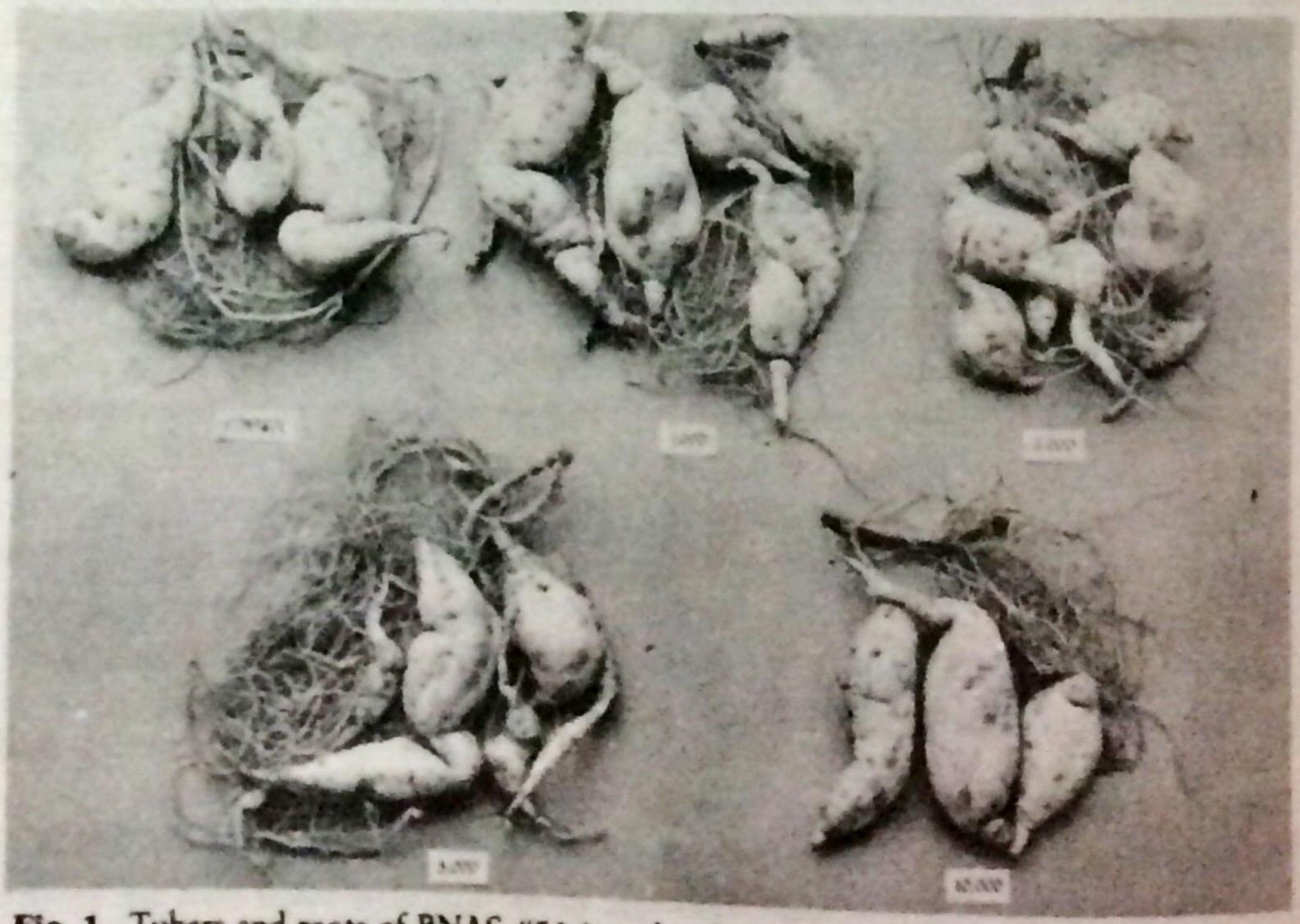

Fig. 1. Tubers and roots of BNAS #51 inoculated with *Helicotylenchus* spp. at different inoculum levels.

more sites for nutrient uptake of plant, resulting in an increase in top weight. The same results were observed by other workers. Apt and Koike (1962) reported that top growth of sugarcane seedlings was greater with an infection level of 100 *Trichodorus christiei* than with 0, 1,000 or 5,000 individuals. Malek and Jenkins (1964) added that top growth may be stimulated by low number of nematodes as a result of root proliferation and that growth is not retarded until the number reached a very high level (10,000 nematodes).

Nematode Population in Roots and Soil.

Nematode recoveries from the soil and roots suggested that there was an increase in the final nematode population in plants inoculated with the lowest population of nematodes (Table 1). However, at an initial population of 3,000, 5,000 and 10,000, the population decreased by 56.38%, 62.45% and 34.82%, respectively. The percent mean population of nematodes from the initial inoculum in the various treatments was highly significant. No nematode was observed in the soil and roots of uninoculated plants. Recovered nematodes were identified and few specimens were found to be *Helicotylenchus pseudorobustus* (Steiner) Golden.

During the growing season of sweet potato, several generations were produced from the initial population of the nematodes. It seems that at the 1,000 initial inoculum level, the nematodes multiplied faster because of more feeding sites and less competition. Competition could probably account for the decrease in final population in roots of plants inoculated with higher nematode populations. Gapasin (1978) found in his experiments that *Rotylenchulus reniformis* at an initial population level of 500 increases after 4 months perhaps owing to less competition.

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